

Topic Hotlist: Forces of Flight

Introduction

This is a collection of Internet sites about the forces of flight, with a special emphasis on Bernoulli's Principle

Internet Resources

Forces of Flight

<http://www.fi.edu/flights/own2/forces.html> is the site provided by the Franklin Institute in Philadelphia. This site provides colorful, well-designed graphics and easy-to-read explanations. Appropriate for grades 4 – 8.

<http://www.planemath.com/activities/pmenterprises/forces/forces1.html> is a tutorial written by a former elementary school teacher for beginner pilots. This site has some nice graphs that engage students in thinking about how pressure and forces change with changes in velocity. Appropriate for grades 6-9.

<http://www.allstar.fiu.edu/aero/fltmidfly.htm> is a site partially funded by NASA that provides some of the mathematical details about how to calculate forces of flight. This site also has some great video animations about the flight control surfaces and definitions of pitch, roll, and yaw. Appropriate for grades 9 – 12.

<http://www.wpafb.af.mil/museum/zone/ff1.htm> is a site from the US Air Force Museum that has some basic explanations of the forces of flight with simple pictures and arrows. Appropriate for grades 4 – 8.

<http://wings.avkids.com/Book/Flight/advanced/index.html> is a site with mostly text that is written for kids to understand basic aerodynamics and aerodynamic forces. Appropriate for grades 6 – 9.

<http://www.nasm.edu/galleries/gal109/NEWHTF/HTF030.HTM> is a site from the Smithsonian's National Air and Space museum that discusses how things fly and the forces of flight. Appropriate for grades 6 – 9.

<http://home.earthlink.net/~voraze/rocketry/lp.html> is a site with lessons plans related to flight forces and using model rockets to help students become interested in why things fly and basic aerodynamics. Appropriate for grades 6 – 9.

<http://www.howstuffworks.com/airplane.htm> is the "How Stuff Works" site explanation of how things fly. Appropriate for grades 6 – 9.

Internet Resources (continued)

Bernoulli's Principle

<http://www.sasked.gov.sk.ca/docs/physics/u6e3phy.html> is a site with the mathematical formulas that describe Bernoulli's Principle and some sample lesson plans. Appropriate for grades 9 – 12.

<http://www.aa.washington.edu/faculty/eberhardt/lift.htm> is a site that explains why the “popular” definition of why airplanes fly is not complete. Appropriate for grades 9 – 12.

<http://www.mste.uiuc.edu/davea/aviation/bernoulliPrinciple.html> is a site that explores Bernoulli's Principle as inquiry. Appropriate for grades 9 – 12.

http://theory.uwinnipeg.ca/mod_tech/node68.html

<http://www.sciencejoywagon.com/physicszone/lesson/02forces/bernoulli/bernoulli.htm> is a site that includes demonstrations and examples of Bernoulli's Principle.

http://observe.ivv.nasa.gov/nasa/education/teach_guide/planes_fly.html is the NASA site explaining how planes fly.

<http://pilotsweb.com/principle/bernoulli.htm> is a site with a simple picture and explanation of Bernoulli's Principle.

<http://nasaui.ited.uidaho.edu/curriculum/velocity.htm> is a site with teacher demos of Bernoulli's Principle.

http://www.carolina.com/calendar_activities/2001/0109.asp is the Carolina Science Supply company's list of B. Principle demos.

<http://www.spartechsoftware.com/reeko/Experiments/AttractingCups.htm> is a neat demo of Bernoulli's Principle.

<http://www.wpafb.af.mil/museum/edu/soar2d.htm> has more demos of Bernoulli's Principle.

<http://www.dfrc.nasa.gov/trc/k4guide/06PaperBag.pdf> has an easy demo for elementary school kids learning about Bernoulli's Principle.

Standards

This Topic Hotlist partially fulfills the following national standards from the AAAS Benchmarks for Science Literacy:

Habits of Mind: Critical Response Skills: By the end of the 12th grade, students should:

- Be aware, when considering claims, that when people try to prove a point, they may select only the data that support it and ignore any that would contradict it.
- Suggest alternative ways of explaining data and criticize arguments in which data, explanations, or conclusions are represented as the only ones worth consideration, with no mention of other possibilities. Similarly, suggest alternative trade-offs in decisions and designs and criticize those in which major trade-offs are not acknowledged.

Habits of Mind: Values and Attitudes: By the end of the 12th grade, students should:

- Know why curiosity, honesty, openness, and skepticism are so highly regarded in science and how they are incorporated into the way science is carried out; exhibit those traits in their own lives and value them in others.

Historical Perspectives: Uniting the Heavens and Earth: By the end of the 12th grade, students should know that:

- Newton's system was based on the concepts of mass, force, and acceleration, his three laws of motion relating them, and a physical law stating that the force of gravity between any two objects in the universe depends only upon their masses and the distance between them.

Suggested Evaluation Rubric

<i>Outline</i>	Outline is submitted on time and shows evidence of research and organization. (5points)	Outline is submitted on time, but ends some revision. (4 points)	Outline is 1-2 days late, or does not show evidence of research or thoughtful consideration. (1-3 points)	Outline is never submitted. (0 points)
<i>Scientific Accuracy of Information Presented</i>	All science information is accurate, references are provided, units are evident and clear, equations and data are explained. (30 points)	Only one or two points of information are not correct or adequately explained. Some units are missing. (20 points)	Many points of information are incorrect or are not explained. (10 points)	Most of the information is incorrect and nothing is explained or cited. (0-5 points)
<i>Completeness of Presentation</i>	The presentation includes adequate material to fully understand how airplanes fly. (25 points)	The presentation includes a basic understanding of how airplanes fly, but there are a few points missing that should be added for full understanding. (20 points)	The presentation includes some useful information, but there are big gaps that are never addressed in the presentation. (15 points)	The audience does not have a better understanding of how airplanes fly then they did before seeing the presentation. (0-10points)
<i>Technical Terms Explained Well</i>	All technical terms are well defined and the teams use demonstrations and analogies to explain these terms. (20 points)	Most technical terms are well-defined and the teams use demonstrations and analogies to explain these terms. (15 points)	Technical terms are vague and there are only a few analogies or demonstrations used to explain terms. (10 points)	Most terms go undefined and there is no attempt to explain or demonstrate the terms. (0-5 points)

Presentation is Well-Organized	Well-organized, presenters show clear evidence of preparation. Appropriate use of multimedia. (20 points)	Organization is good; preparation is evident. Multimedia component is included but may have been used more effectively. (15 points)	Organization needs improvement. There seems to be a lack of preparation and team work in the presentation. Little use of multimedia, or multimedia is not integrated into the presentation. (10 points)	Little evidence of preparation or organization. Multimedia is not used at all. (0-5 points)
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Notes to the Educator/Parent

Teachers and Parents,

The main idea for this WebQuest came from the article at <http://www.aa.washington.edu/faculty/eberhardt/lift.htm>

It is worth reading this article before assigning this WebQuest to students. It discusses the different explanations for how airplanes fly and looks at some of the challenges to teachers and students regarding only using Bernoulli's Principle to discuss how airplanes fly. In a physics class, students should be able to find specific information about the characteristics of one aircraft (such as the Cessna 172, see <http://skyhawk.cessna.com/specs.shtml>). Using data from this plane, student calculations should show that Bernoulli's Principle alone is not sufficient to account for all the lift necessary for this plane to fly.

A great place to start, if students are new to WebQuests is "A Webquest about Webquests" at <http://edweb/sdsu.edu/webquest/webquestwebquest-hs.html>

This WebQuest is appropriate for grades 9-12 as part of a physics or physical science class, but it could be modified to just discuss the forces of flight for grades 5-8.

Here is an outline of how this WebQuest could be used in class, together with other ongoing lessons, for approximately 2 weeks:

- (1) Start unit on Bernoulli's Principle and discuss the forces of flight
- (2) Assign students to groups of 4
- (3) Groups meet and select roles (the teacher may choose to assign these roles ahead of time).
- (4) Students work online to gather information and submit an initial outline for their show.
- (5) With feedback on their outlines, students develop their show with more

(8) Students present their shows.

This WebQuest can also be used as part of a series of WebQuests that students choose as part of a term project. This prevents having to listen to six presentations all on how airplanes fly.